



US-162
SEQUENCE LISTING

<110> Yumi Matsuzaki, Jun Nakamura and Kenichi Hashiguchi
<120> Method for producing L-arginine or L-lysine by fermentation
<130> US-162
<140> US/10/790,224
<141> 2004-03-02
<150> JP 2003-056129
<151> 2003-03-03
<160> 24
<170> PatentIn Ver. 2.0

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<213> Brevibacterium flavum

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<222> (1852)..(2364)

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Met Ser

1

ctt ggc tca acc ccg tca aca ccg gaa aac tta aat ccc gtg act⁻cgc 1905

Leu Gly Ser Thr Pro Ser Thr Pro Glu Asn Leu Asn Pro Val Thr Arg

四

15

1905

act qca cgc caa gct ctc att ttg caq att ttg gac aaa caa aaa gtc 1953

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Ile Thr Gln Ala Thr Leu Ser Arg Asp Leu Asp Glu Leu Gly Ala Arg	
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<213> *Brevibacterium flavum*

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Ile	Asp	Ile	Thr	Gln	Ala	Thr	Leu	Ser	Arg	Asp	Leu	Asp	Glu	Leu	Gly
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Pro	Val	Asp	Ser	Ile	Ala	Arg	Glu	Asp	Leu	Arg	Gly	Pro	Ser	Glu	Lys
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Leu	Arg	Arg	Met	Leu	Asp	Glu	Leu	Leu	Val	Ser	Thr	Asp	His	Ser	Gly
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Asn	Ile	Ala	Met	Leu	Arg	Thr	Pro	Pro	Gly	Ala	Ala	Gln	Tyr	Leu	Ala
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Ser	Phe	Ile	Asp	Arg	Val	Gly	Leu	Lys	Glu	Val	Val	Gly	Thr	Ile	Ala
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<213> *Brevibacterium lactofermentum*

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<222> (1)..(3138)

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Asp	Pro	Leu	Pro	Lys	Val	Gly	Ser	Leu	Ser	Leu	Lys	Ser	Glu	His	Ala
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caa	gca	gat	cta	gag	cat	ttg	ggt	tgg	cgc	aat	gtt	gag	tct	ttg	gat
Gln	Ala	Asp	Leu	Glu	His	Leu	Gly	Trp	Arg	Asn	Val	Glu	Ser	Leu	Asp
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ttg	ttg	tgg	ggc	ttg	tca	ggt	gca	ggc	gat	ccc	gat	gtc	gcg	ctg	aac
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Leu	Leu	Ile	Arg	Leu	Tyr	Gln	Ala	Leu	Glu	Ala	Ile	Gly	Glu	Asp	Ala	
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cga	aac	gag	ctt	gat	caa	gag	att	cgc	cag	gat	gaa	gaa	cta	cga	gtc	288
Arg	Asn	Glu	Leu	Asp	Gln	Glu	Ile	Arg	Gln	Asp	Glu	Glu	Leu	Arg	Val	
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cgc	ctt	ttt	gca	ttg	ttg	ggt	ggt	tcc	tcg	gct	gtc	ggt	gat	cac	ttg	336
Arg	Leu	Phe	Ala	Leu	Leu	Gly	Gly	Ser	Ser	Ala	Val	Gly	Asp	His	Leu	
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gtc	gcc	aat	cct	ttg	cag	tgg	aaa	ctc	tta	aaa	ctt	gat	gcg	cca	tcg	384
Val	Ala	Asn	Pro	Leu	Gln	Trp	Lys	Leu	Leu	Lys	Leu	Asp	Ala	Pro	Ser	
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agg	gaa	gag	atg	ttt	cag	gcg	ctg	ctg	gaa	tct	gtg	aaa	gct	cag	cct	432
Arg	Glu	Glu	Met	Phe	Gln	Ala	Leu	Leu	Glu	Ser	Val	Lys	Ala	Gln	Pro	
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Ala	Val	Leu	Glu	Val	Glu	Asp	Phe	Ser	Asp	Ala	His	Asn	Ile	Ala	Arg	
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gac	gat	ttg	agc	acg	cct	ggt	ttt	tac	acg	gct	agt	gtt	acc	ggg	cct	528
Asp	Asp	Leu	Ser	Thr	Pro	Gly	Phe	Tyr	Thr	Ala	Ser	Val	Thr	Gly	Pro	
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att	gct	gcg	cat	gat	tta	gcg	ggt	acc	tat	ccc	acc	gac	atg	cgg	aga	624
Ile	Ala	Ala	His	Asp	Leu	Ala	Gly	Thr	Tyr	Pro	Thr	Asp	Met	Arg	Arg	
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Asn	Val	Tyr	Gly	Glu	Lys	Pro	Val	Asp	Ser	Ala	Leu	Ser	Val	Ile	Ala	
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gtg	gtg	ttt	gtt	gca	gag	ccg	gca	aac	tct	aaa	tca	aca	cgc	acc	gca	864
Val	Val	Phe	Val	Ala	Glu	Pro	Ala	Asn	Ser	Lys	Ser	Thr	Arg	Thr	Ala	
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gca	gag	ctc	att	cgc	atc	ggt	agc	aac	tcg	ttc	ttt	gag	gtg	gat	gca	912
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tcc	cat	atg	gcg	tat	tac	aag	cgc	tgg	gcg	gaa	acc	tgg	gaa	ttt	cag	1008
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gca	ctg	ctg	aaa	gct	cgt	ccc	atg	acg	ggt	gat	att	gac	ctt	ggg	cag	1056
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gaa tca ttt gtc aca gat gtc caa gct atg cgc cgt cga gtg ttg gac			1152
Glu Ser Phe Val Thr Asp Val Gln Ala Met Arg Arg Arg Val Leu Asp			
370 375 380			
aat gtt ccg gaa gac ttg cgt gat cgt gag ctg aag ctt ggt cgc ggt			1200
Asn Val Pro Glu Asp Leu Arg Asp Arg Glu Leu Lys Leu Gly Arg Gly			
385 390 395 400			
ggt ttg agg gat gtg gag ttt gct gtc cag ctc ctt cag atg gtg cat			1248
Gly Leu Arg Asp Val Glu Phe Ala Val Gln Leu Leu Gln Met Val His			
405 410 415			
ggt cgc att gat gag acg ttg cgg gtt cgg tca acg gta aat gct ttg			1296
Gly Arg Ile Asp Glu Thr Leu Arg Val Arg Ser Thr Val Asn Ala Leu			
420 425 430			
cat gtg ttg gtt gat cag gga tat gtg ggt cgt gaa gac ggg cat aat			1344
His Val Leu Val Asp Gln Gly Tyr Val Gly Arg Glu Asp Gly His Asn			
435 440 445			
ctc att gag tcg tat gag ttt ttg cgc ctg ttg gag cat cgc ctt caa			1392
Leu Ile Glu Ser Tyr Glu Phe Leu Arg Leu Leu Glu His Arg Leu Gln			
450 455 460			
ttg gag cgg atc aag cgc act cac ttg tta ccg aaa cct gat gac cga			1440
Leu Glu Arg Ile Lys Arg Thr His Leu Leu Pro Lys Pro Asp Asp Arg			
465 470 475 480			
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485 490 495			
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Glu Gln Ser Ser Ala Lys Ala Met Glu Arg His Leu Arg Lys Val Arg			
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565 570 575			
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Ala Ser Tyr Asp Arg Ser Trp Phe Leu Arg Met Leu Arg Asp Glu Gly			
610 615 620			
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Val Val Gly Gln Arg Leu Met Arg Ile Leu Gly Asn Ser Pro Tyr Ile			
625 630 635 640			

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tct	gaa	ctg	att	atc	tcc	act	ccg	gac	ttt	gtg	aaa	cag	ctg	ggt	gat		1968
Ser	Glu	Leu	Ile	Ile	Ser	Thr	Pro	Asp	Phe	Val	Lys	Gln	Leu	Gly	Asp		
																655	
																645	650
gcg	gcg	tct	ggt	cct	aaa	ttg	ctt	gct	act	gca	ccg	act	cag	gtt	gtg		2016
Ala	Ala	Ser	Gly	Pro	Lys	Leu	Leu	Ala	Thr	Ala	Pro	Thr	Gln	Val	Val		
																660	665
																670	670
aaa	gca	atc	aag	gcf	acg	gtg	tcg	cgt	cat	gag	tca	cct	gat	cgg	gcf		2064
Lys	Ala	Ile	Lys	Ala	Thr	Val	Ser	Arg	His	Glu	Ser	Pro	Asp	Arg	Ala		
																675	680
																685	685
atc	cag	gct	gca	cga	tcg	ctg	agg	agg	cag	gag	ctg	gca	cgc	att	gcc		2112
Ile	Gln	Ala	Ala	Arg	Ser	Leu	Arg	Arg	Gln	Glu	Leu	Ala	Arg	Ile	Ala		
																690	695
																700	700
tct	gct	gat	ttg	ctc	aac	atg	ctc	act	gtt	cag	gaa	gta	tgc	caa	agc		2160
Ser	Ala	Asp	Leu	Leu	Asn	Met	Leu	Thr	Val	Gln	Glu	Val	Cys	Gln	Ser		
																705	710
																715	720
ttg	tca	cta	gtc	tgg	gat	gcf	gtg	ttg	gat	gct	gcc	ttg	gat	gcf	gaa		2208
Leu	Ser	Leu	Val	Trp	Asp	Ala	Val	Leu	Asp	Ala	Ala	Leu	Asp	Ala	Glu		
																725	730
																735	735
atc	cgt	gct	gca	ctt	aac	gat	cca	cag	aaa	cca	gat	cag	cct	ctg	gcc		2256
Ile	Arg	Ala	Ala	Leu	Asn	Asp	Pro	Gln	Lys	Pro	Asp	Gln	Pro	Leu	Ala		
																740	745
																750	750
aat	att	tct	gtg	atc	ggc	atg	ggc	cgt	ttg	ggt	gga	gca	gaa	ctt	gga		2304
Asn	Ile	Ser	Val	Ile	Gly	Met	Gly	Arg	Leu	Gly	Gly	Ala	Glu	Leu	Gly		
																755	760
																765	765
tac	ggt	tct	gat	gcc	gat	gtg	atg	ttt	gta	tgc	gag	ccg	gta	gcc	ggt		2352
Tyr	Gly	Ser	Asp	Ala	Asp	Val	Met	Phe	Val	Cys	Glu	Pro	Val	Ala	Gly		
																770	775
																780	780
gtg	gaa	gag	cat	gag	gcc	gtc	aca	tgg	tct	att	gcf	atc	tgt	gat	tcc		2400
Val	Glu	Glu	His	Glu	Ala	Val	Thr	Trp	Ser	Ile	Ala	Ile	Cys	Asp	Ser		
																785	790
																795	800
atg	cgg	tcg	agg	ctt	gcf	cag	cct	tcc	ggt	gat	cca	cct	ttg	gag	gtg		2448
Met	Arg	Ser	Arg	Leu	Ala	Gln	Pro	Ser	Gly	Asp	Pro	Pro	Leu	Glu	Val		
																805	810
																815	815
gat	ctg	ggg	ctg	cgt	cct	gaa	ggg	aga	tct	ggt	gcf	att	gtg	cgc	acc		2496
Asp	Leu	Gly	Leu	Arg	Pro	Glu	Gly	Arg	Ser	Gly	Ala	Ile	Val	Arg	Thr		
																820	825
																830	830
gtt	gat	tcc	tat	gtg	aag	tac	tac	gaa	aag	tgg	ggt	gaa	act	tgg	gag		2544
Val	Asp	Ser	Tyr	Val	Lys	Tyr	Tyr	Glu	Lys	Trp	Gly	Glu	Thr	Trp	Glu		
																835	840
																845	845
att	cag	gcf	ctg	ctg	agg	gct	gcf	tgg	gtt	gct	ggt	gat	cgt	gag	ctg		2592
Ile	Gln	Ala	Leu	Leu	Arg	Ala	Ala	Trp	Val	Ala	Gly	Asp	Arg	Glu	Leu		
																850	855
																860	860
ggc	att	aag	tcc	ttg	gag	tcg	att	gat	cgt	tcc	cgc	tac	cca	gtt	gac		2640
Gly	Ile	Lys	Phe	Leu	Glu	Ser	Ile	Asp	Arg	Phe	Arg	Tyr	Pro	Val	Asp		
																865	870
																875	880
ggg	gca	acg	cag	gcf	cag	ctt	cgt	gaa	gtt	cgt	cga	att	aag	gcf	agg		2688
Gly	Ala	Thr	Gln	Ala	Gln	Leu	Arg	Glu	Val	Arg	Arg	Ile	Lys	Ala	Arg		
																885	890
																895	895
gtg	gat	aat	gag	agg	ctt	ccg	cgc	ggg	gct	gat	cga	aat	acc	cat	acc		2736
Val	Asp	Asn	Glu	Arg	Leu	Pro	Arg	Gly	Ala	Asp	Arg	Asn	Thr	His	Thr		
																900	905
																910	910
aag	ctg	ggt	cgf	gga	gcf	tta	act	gac	atc	gag	tgg	act	gtg	cag	ttg		2784
Lys	Leu	Gly	Arg	Gly	Ala	Leu	Thr	Asp	Ile	Glu	Trp	Thr	Val	Gln	Leu		
																915	920
																925	925
ttg	acc	atg	atg	cat	gct	cat	gag	att	ccg	gag	ctg	cac	aat	acg	tcg		2832

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Leu	Thr	Met	Met	His	Ala	His	Glu	Ile	Pro	Glu	Leu	His	Asn	Thr	Ser	
930				935						940						
acg	ttg	gaa	gtt	ctt	gaa	gtg	ctg	gaa	aag	cat	cag	att	att	aac	cct	2880
Thr	Leu	Glu	Val	Leu	Glu	Val	Leu	Glu	Lys	His	Gln	Ile	Ile	Asn	Pro	
945				950					955						960	
gtg	cag	gtg	cag	acg	ctt	cgg	gaa	gcf	tgg	ctg	acg	gca	acg	gct	gct	2928
Val	Gln	Val	Gln	Thr	Leu	Arg	Glu	Ala	Trp	Leu	Thr	Ala	Thr	Ala	Ala	
										965		970		975		
agg	aat	gcg	ctt	gtg	ctg	gtc	agg	ggt	aag	aga	tta	gat	cag	tta	cct	2976
Arg	Asn	Ala	Leu	Val	Leu	Val	Arg	Gly	Lys	Arg	Leu	Asp	Gln	Leu	Pro	
										980		985		990		
act	cct	ggc	ccg	cac	ctt	gcf	cag	gtg	gct	ggt	gcf	tct	ggc	tgg	gat	3024
Thr	Pro	Gly	Pro	His	Leu	Ala	Gln	Val	Ala	Gly	Ala	Ser	Gly	Trp	Asp	
										995		1000		1005		
cca	aat	gag	tac	cag	gag	tat	ttg	gaa	aac	tat	ctg	aaa	gtg	acc	agg	3072
Pro	Asn	Glu	Tyr	Gln	Glu	Tyr	Leu	Glu	Asn	Tyr	Leu	Lys	Val	Thr	Arg	
										1010		1015		1020		
aag	agt	cgt	cag	gtt	gtt	gat	gaa	gtc	tcc	tgg	ggt	gtg	gac	tct	atg	3120
Lys	Ser	Arg	Gln	Val	Val	Asp	Glu	Val	Phe	Trp	Gly	Val	Asp	Ser	Met	
										1025		1030		1035		1040
gag	caa	cgt	gag	ttt	tag											3138
Glu	Gln	Arg	Glu	Phe												
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<210> 18

<211> 1045

<212> PRT

<213> Brevibacterium lactofermentum

Met	Ser	Gly	Pro	Leu	Arg	Ser	Glu	Arg	Lys	Val	Val	Gly	Phe	Val	Arg
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Asp	Pro	Leu	Pro	Lys	Val	Gly	Ser	Leu	Ser	Leu	Lys	Ser	Glu	His	Ala
									20		25			30	
Gln	Ala	Asp	Leu	Glu	His	Leu	Gly	Trp	Arg	Asn	Val	Glu	Ser	Leu	Asp
									35		40			45	
Leu	Leu	Trp	Gly	Leu	Ser	Gly	Ala	Gly	Asp	Pro	Asp	Val	Ala	Leu	Asn
									50		55			60	
Leu	Leu	Ile	Arg	Leu	Tyr	Gln	Ala	Leu	Glu	Ala	Ile	Gly	Glu	Asp	Ala
									65		70			75	
Arg	Asn	Glu	Leu	Asp	Gln	Glu	Ile	Arg	Gln	Asp	Glu	Glu	Leu	Arg	Val
									85		90			95	
Arg	Leu	Phe	Ala	Leu	Leu	Gly	Gly	Ser	Ser	Ala	Val	Gly	Asp	His	Leu
									100		105			110	
Val	Ala	Asn	Pro	Leu	Gln	Trp	Lys	Leu	Leu	Lys	Leu	Asp	Ala	Pro	Ser
									115		120			125	
Arg	Glu	Glu	Met	Phe	Gln	Ala	Leu	Leu	Glu	Ser	Val	Lys	Ala	Gln	Pro
									130		135			140	
Ala	Val	Leu	Glu	Val	Glu	Asp	Phe	Ser	Asp	Ala	His	Asn	Ile	Ala	Arg
									145		150			155	
Asp	Asp	Leu	Ser	Thr	Pro	Gly	Phe	Tyr	Thr	Ala	Ser	Val	Thr	Gly	Pro
									165		170			175	
Glu	Ala	Glu	Arg	Val	Leu	Lys	Trp	Thr	Tyr	Arg	Thr	Leu	Leu	Thr	Arg
									180		185			190	
Ile	Ala	Ala	His	Asp	Leu	Ala	Gly	Thr	Tyr	Pro	Thr	Asp	Met	Arg	Arg

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Lys	Gly	Gly	Asp	Pro	Val	Pro	Phe	Ser	Thr	Val	Thr	Met	Gln	Leu	Ser
195	200	205													
210	215	220													
Asp	Leu	Ala	Asp	Ala	Ala	Leu	Thr	Ala	Ala	Leu	Ala	Val	Ala	Ile	Ala
225	230	235													240
Asn	Val	Tyr	Gly	Glu	Lys	Pro	Val	Asp	Ser	Ala	Leu	Ser	Val	Ile	Ala
															245
Met	Gly	Lys	Cys	Gly	Ala	Gln	Glu	Leu	Asn	Tyr	Ile	Ser	Asp	Val	Asp
															250
Val	Val	Phe	Val	Ala	Glu	Pro	Ala	Asn	Ser	Lys	Ser	Thr	Arg	Thr	Ala
															255
275	280	285													
Ala	Glu	Leu	Ile	Arg	Ile	Gly	Ser	Asn	Ser	Phe	Phe	Glu	Val	Asp	Ala
290	295	300													
Ala	Leu	Arg	Pro	Glu	Gly	Lys	Ser	Gly	Ala	Leu	Val	Arg	Ser	Leu	Asp
305	310	315													320
Ser	His	Met	Ala	Tyr	Tyr	Lys	Arg	Trp	Ala	Glu	Thr	Trp	Glu	Phe	Gln
															325
Ala	Leu	Leu	Lys	Ala	Arg	Pro	Met	Thr	Gly	Asp	Ile	Asp	Leu	Gly	Gln
															340
Ser	Tyr	Val	Asp	Ala	Leu	Ser	Pro	Leu	Ile	Trp	Ala	Ala	Ser	Gln	Arg
															355
Glu	Ser	Phe	Val	Thr	Asp	Val	Gln	Ala	Met	Arg	Arg	Arg	Val	Leu	Asp
															370
Asn	Val	Pro	Glu	Asp	Leu	Arg	Asp	Arg	Glu	Leu	Lys	Leu	Gly	Arg	Gly
385	390	395													400
Gly	Leu	Arg	Asp	Val	Glu	Phe	Ala	Val	Gln	Leu	Leu	Gln	Met	Val	His
															405
Gly	Arg	Ile	Asp	Glu	Thr	Leu	Arg	Val	Arg	Ser	Thr	Val	Asn	Ala	Leu
															420
His	Val	Leu	Val	Asp	Gln	Gly	Tyr	Val	Gly	Arg	Glu	Asp	Gly	His	Asn
															435
Leu	Ile	Glu	Ser	Tyr	Glu	Phe	Leu	Arg	Leu	Leu	Glu	His	Arg	Leu	Gln
															450
Leu	Glu	Arg	Ile	Lys	Arg	Thr	His	Leu	Leu	Pro	Lys	Pro	Asp	Asp	Arg
															465
Met	Asn	Met	Arg	Trp	Leu	Ala	Arg	Ala	Ser	Gly	Phe	Thr	Gly	Ser	Met
															485
Glu	Gln	Ser	Ser	Ala	Lys	Ala	Met	Glu	Arg	His	Leu	Arg	Lys	Val	Arg
															500
Leu	Gln	Ile	Gln	Ser	Leu	His	Ser	Gln	Leu	Phe	Tyr	Arg	Pro	Leu	Leu
															515
Asn	Ser	Val	val	Asn	Leu	Ser	Ala	Asp	Ala	Ile	Arg	Leu	Ser	Pro	Asp
															530
Ala	Ala	Lys	Leu	Gln	Leu	Gly	Ala	Leu	Gly	Tyr	Leu	His	Pro	Ser	Arg
															545
Ala	Tyr	Glu	His	Leu	Thr	Ala	Leu	Ala	Ser	Gly	Ala	Ser	Arg	Lys	Ala
															565
Lys	Ile	Gln	Ala	Met	Leu	Leu	Pro	Thr	Leu	Met	Glu	Trp	Leu	Ser	Gln
															580
Thr	Ala	Glu	Pro	Asp	Ala	Gly	Leu	Leu	Asn	Tyr	Arg	Lys	Leu	Ser	Asp
															595
Ala	Ser	Tyr	Asp	Arg	Ser	Trp	Phe	Leu	Arg	Met	Leu	Arg	Asp	Glu	Gly
															610
625	630	635													
Val	Val	Gly	Gln	Arg	Leu	Met	Arg	Ile	Leu	Gly	Asn	Ser	Pro	Tyr	Ile

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Ser Glu Leu Ile Ile Ser Thr Pro Asp Phe Val Lys Gln Leu Gly Asp
 645 650 655
 Ala Ala Ser Gly Pro Lys Leu Leu Ala Thr Ala Pro Thr Gln Val Val
 660 665 670
 Lys Ala Ile Lys Ala Thr Val Ser Arg His Glu Ser Pro Asp Arg Ala
 675 680 685
 Ile Gln Ala Ala Arg Ser Leu Arg Arg Gln Glu Leu Ala Arg Ile Ala
 690 695 700
 Ser Ala Asp Leu Leu Asn Met Leu Thr Val Gln Glu Val Cys Gln Ser
 705 710 715 720
 Leu Ser Leu Val Trp Asp Ala Val Leu Asp Ala Ala Leu Asp Ala Glu
 725 730 735
 Ile Arg Ala Ala Leu Asn Asp Pro Gln Lys Pro Asp Gln Pro Leu Ala
 740 745 750
 Asn Ile Ser Val Ile Gly Met Gly Arg Leu Gly Gly Ala Glu Leu Gly
 755 760 765
 Tyr Gly Ser Asp Ala Asp Val Met Phe Val Cys Glu Pro Val Ala Gly
 770 775 780
 Val Glu Glu His Glu Ala Val Thr Trp Ser Ile Ala Ile Cys Asp Ser
 785 790 795 800
 Met Arg Ser Arg Leu Ala Gln Pro Ser Gly Asp Pro Pro Leu Glu Val
 805 810 815
 Asp Leu Gly Leu Arg Pro Glu Gly Arg Ser Gly Ala Ile Val Arg Thr
 820 825 830
 Val Asp Ser Tyr Val Lys Tyr Glu Lys Trp Gly Glu Thr Trp Glu
 835 840 845
 Ile Gln Ala Leu Leu Arg Ala Ala Trp Val Ala Gly Asp Arg Glu Leu
 850 855 860
 Gly Ile Lys Phe Leu Glu Ser Ile Asp Arg Phe Arg Tyr Pro Val Asp
 865 870 875 880
 Gly Ala Thr Gln Ala Gln Leu Arg Glu Val Arg Arg Ile Lys Ala Arg
 885 890 895
 Val Asp Asn Glu Arg Leu Pro Arg Gly Ala Asp Arg Asn Thr His Thr
 900 905 910
 Lys Leu Gly Arg Gly Ala Leu Thr Asp Ile Glu Trp Thr Val Gln Leu
 915 920 925
 Leu Thr Met Met His Ala His Glu Ile Pro Glu Leu His Asn Thr Ser
 930 935 940
 Thr Leu Glu Val Leu Glu Val Leu Glu Lys His Gln Ile Ile Asn Pro
 945 950 955 960
 Val Gln Val Gln Thr Leu Arg Glu Ala Trp Leu Thr Ala Thr Ala Ala
 965 970 975
 Arg Asn Ala Leu Val Leu Val Arg Gly Lys Arg Leu Asp Gln Leu Pro
 980 985 990
 Thr Pro Gly Pro His Leu Ala Gln Val Ala Gly Ala Ser Gly Trp Asp
 995 1000 1005
 Pro Asn Glu Tyr Gln Glu Tyr Leu Glu Asn Tyr Leu Lys Val Thr Arg
 1010 1015 1020
 Lys Ser Arg Gln Val Val Asp Glu Val Phe Trp Gly Val Asp Ser Met
 1025 1030 1035 1040
 Glu Gln Arg Glu Phe
 1045

<210> 19
 <211> 1434

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<212> DNA
 <213> *Brevibacterium lactofermentum*
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aac gtc gag ttc gtt gac gtt cga ttc acc gac ctt ccc ggc acc gag	96	
Asn Val Glu Phe Val Asp Val Arg Phe Thr Asp Leu Pro Gly Thr Glu		
20 25 30		
cag cac ttc agc atc cca gct gcc agc ttc gat gca gat aca gtc gaa	144	
Gln His Phe Ser Ile Pro Ala Ala Ser Phe Asp Ala Asp Thr Val Glu		
35 40 45		
gaa ggt ctc gca ttc gac gga tcc tcg atc cgt ggc ttc acc acg atc	192	
Glu Gly Leu Ala Phe Asp Gly Ser Ser Ile Arg Gly Phe Thr Thr Ile		
50 55 60		
gac gaa tct gac atg aat ctc ctg cca gac ctc gga acg gcc acc ctt	240	
Asp Glu Ser Asp Met Asn Leu Leu Pro Asp Leu Gly Thr Ala Thr Leu		
65 70 75 80		
gat cca ttc cgc aag gca aag acc ctg aac gtt aag ttc ttc gtt cac	288	
Asp Pro Phe Arg Lys Ala Lys Thr Leu Asn Val Lys Phe Phe Val His		
85 90 95		
gat cct ttc acc cgc gag gca ttc tcc cgc gac cca cgc aac gta gca	336	
Asp Pro Phe Thr Arg Glu Ala Phe Ser Arg Asp Pro Arg Asn Val Ala		
100 105 110		
cgc aag gca gag cag tac ctg gca tcc acc ggc att gca gac acc tgc	384	
Arg Lys Ala Glu Gln Tyr Leu Ala Ser Thr Gly Ile Ala Asp Thr Cys		
115 120 125		
aac ttc ggc gcc gag gct gag ttc tac ctc ttc gac tcc gtt cgc tac	432	
Asn Phe Gly Ala Glu Ala Glu Phe Tyr Leu Phe Asp Ser Val Arg Tyr		
130 135 140		
tcc acc gag atg aac tcc ggc ttc tac gaa gta gat acc gaa gaa ggc	480	
Ser Thr Glu Met Asn Ser Gly Phe Tyr Glu Val Asp Thr Glu Glu Gly		
145 150 155 160		
tgg tgg aac cgt ggc aag gaa acc aac ctc gac gga acc cca aac ctg	528	
Trp Trp Asn Arg Gly Lys Glu Thr Asn Leu Asp Gly Thr Pro Asn Leu		
165 170 175		
ggc gca aag aac cgc gtc aag ggt ggc tac ttc cca gta gca cca tac	576	
Gly Ala Lys Asn Arg Val Lys Gly Gly Tyr Phe Pro Val Ala Pro Tyr		
180 185 190		
gac caa acc gtt gac gtg cgc gat gac atg gtt cgc aac ctc gca gct	624	
Asp Gln Thr Val Asp Val Arg Asp Asp Met Val Arg Asn Leu Ala Ala		
195 200 205		
tcc ggc ttc gct ctt gag cgt ttc cac cac gaa gtc ggt ggc gga cag	672	
Ser Gly Phe Ala Leu Glu Arg Phe His His Glu Val Gly Gly Gly Gln		
210 215 220		
cag gaa atc aac tac cgc ttc aac acc atg ctc cac gcg gca gat gat	720	
Gln Glu Ile Asn Tyr Arg Phe Asn Thr Met Leu His Ala Ala Asp Asp		
225 230 235 240		
atc cag acc ttc aag tac atc atc aag aac acc gct cgc ctc cac ggc	768	
Ile Gln Thr Phe Lys Tyr Ile Ile Lys Asn Thr Ala Arg Leu His Gly		

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	245		250		255											
aag	gct	gca	acc	ttc	atg	cct	aag	cca	ctg	gct	gac	gac	aac	ggc	tcc	816
Lys	Ala	Ala	Thr	Phe	Met	Pro	Lys	Pro	Leu	Ala	Gly	Asp	Asn	Gly	Ser	
	260			265					270							
ggc	atg	cac	gct	cac	cag	tcc	ctc	tgg	aag	gac	ggc	aag	cca	ctc	tcc	864
Gly	Met	His	Ala	His	Gln	Ser	Leu	Trp	Lys	Asp	Gly	Lys	Pro	Leu	Phe	
	275			280					285							
cac	gat	gag	tcc	ggc	tac	gca	ggc	ctg	tcc	gac	atc	gcc	cgc	tac	tac	912
His	Asp	Glu	Ser	Gly	Tyr	Ala	Gly	Leu	Ser	Asp	Ile	Ala	Arg	Tyr	Tyr	
	290			295					300							
atc	ggc	ggc	atc	ctg	cac	cac	gca	ggc	gct	gtt	ctg	gcg	ttc	acc	aac	960
Ile	Gly	Gly	Ile	Leu	His	His	Ala	Gly	Ala	Val	Leu	Ala	Phe	Thr	Asn	
	305			310					315						320	
gca	acc	ctg	aac	tcc	tac	cac	cgt	ctg	gtt	cca	ggc	ttc	gag	gct	cca	1008
Ala	Thr	Leu	Asn	Ser	Tyr	His	Arg	Leu	Val	Pro	Gly	Phe	Glu	Ala	Pro	
	325			330					335							
atc	aac	ctg	gtg	tac	tca	cag	cgc	aac	cgt	tcc	gct	gct	gtc	cgt	atc	1056
Ile	Asn	Leu	Val	Tyr	Ser	Gln	Arg	Asn	Arg	Ser	Ala	Ala	Val	Arg	Ile	
	340			345					350							
cca	atc	acc	gga	tcc	aac	cca	aag	gca	aag	cgc	atc	gaa	ttc	cgc	gct	1104
Pro	Ile	Thr	Gly	Ser	Asn	Pro	Lys	Ala	Lys	Arg	Ile	Glu	Phe	Arg	Ala	
	355			360					365							
cca	gac	cca	tca	ggc	aac	cca	tac	ctg	ggc	ttc	gca	gcg	atg	atg	atg	1152
Pro	Asp	Pro	Ser	Gly	Asn	Pro	Tyr	Leu	Gly	Phe	Ala	Ala	Met	Met	Met	
	370			375					380							
gcc	ggc	ctc	gac	ggc	atc	aag	aac	cgc	atc	gag	cca	cac	gct	cca	gtg	1200
Ala	Gly	Leu	Asp	Gly	Ile	Lys	Asn	Arg	Ile	Glu	Pro	His	Ala	Pro	Val	
	385			390					395						400	
gac	aag	gac	ctc	tac	gaa	ctg	cca	cca	gag	gaa	gct	gca	tcc	att	cca	1248
Asp	Lys	Asp	Leu	Tyr	Glu	Leu	Pro	Pro	Glu	Glu	Ala	Ala	Ser	Ile	Pro	
	405			410					415							
cag	gca	cca	acc	tcc	ctg	gaa	gca	tcc	ctg	aag	gca	ctg	cag	gaa	gac	1296
Gln	Ala	Pro	Thr	Ser	Leu	Glu	Ala	Ser	Leu	Lys	Ala	Leu	Gln	Glu	Asp	
	420			425					430							
acc	gac	ttc	ctc	acc	gag	tct	gac	gtc	ttc	acc	gag	gat	ctc	atc	gag	1344
Thr	Asp	Phe	Leu	Thr	Glu	Ser	Asp	Val	Phe	Thr	Glu	Asp	Leu	Ile	Glu	
	435			440					445							
gcg	tac	atc	cag	tac	aag	tac	gac	aac	gag	atc	tcc	cca	gtt	cgc	ctg	1392
Ala	Tyr	Ile	Gln	Tyr	Lys	Tyr	Asp	Asn	Glu	Ile	Ser	Pro	Val	Arg	Leu	
	450			455					460							
cgc	cca	acc	ccg	cag	gaa	ttc	gaa	ttg	tac	ttc	gac	tgc	taa			1434
Arg	Pro	Thr	Pro	Gln	Glu	Phe	Glu	Leu	Tyr	Phe	Asp	Cys				
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<210> 20

<211> 477

<212> PRT

<213> Brevibacterium lactofermentum

<400> 20

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Val Ala Phe Glu Thr Pro Glu Glu Ile Val Lys Phe Ile Lys Asp Glu
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Asn Val Glu Phe Val Asp Val Arg Phe Thr Asp Leu Pro Gly Thr Glu
      20          25          30
Gln His Phe Ser Ile Pro Ala Ala Ser Phe Asp Ala Asp Thr Val Glu

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Glu	Gly	Leu	Ala	Phe	Asp	Gly	Ser	Ser	Ile	Arg	Gly	Phe	Thr	Thr	Ile
35					40						45				
50					55					60					
Asp	Glu	Ser	Asp	Met	Asn	Leu	Leu	Pro	Asp	Leu	Gly	Thr	Ala	Thr	Leu
65					70					75					80
Asp	Pro	Phe	Arg	Lys	Ala	Lys	Thr	Leu	Asn	Val	Lys	Phe	Phe	Val	His
					85					90					95
Asp	Pro	Phe	Thr	Arg	Glu	Ala	Phe	Ser	Arg	Asp	Pro	Arg	Asn	Val	Ala
					100					105					110
Arg	Lys	Ala	Glu	Gln	Tyr	Leu	Ala	Ser	Thr	Gly	Ile	Ala	Asp	Thr	Cys
					115					120					125
Asn	Phe	Gly	Ala	Glu	Ala	Glu	Phe	Tyr	Leu	Phe	Asp	Ser	Val	Arg	Tyr
					130					135					140
Ser	Thr	Glu	Met	Asn	Ser	Gly	Phe	Tyr	Glu	Val	Asp	Thr	Glu	Glu	Gly
145					150					155					160
Trp	Trp	Asn	Arg	Gly	Lys	Glu	Thr	Asn	Leu	Asp	Gly	Thr	Pro	Asn	Leu
					165					170					175
Gly	Ala	Lys	Asn	Arg	Val	Lys	Gly	Gly	Tyr	Phe	Pro	Val	Ala	Pro	Tyr
					180					185					190
Asp	Gln	Thr	Val	Asp	Val	Arg	Asp	Asp	Met	Val	Arg	Asn	Leu	Ala	Ala
					195					200					205
Ser	Gly	Phe	Ala	Leu	Glu	Arg	Phe	His	His	Glu	Val	Gly	Gly	Gly	Gln
					210					215					220
Gln	Glu	Ile	Asn	Tyr	Arg	Phe	Asn	Thr	Met	Leu	His	Ala	Ala	Asp	Asp
225					230					235					240
Ile	Gln	Thr	Phe	Lys	Tyr	Ile	Ile	Lys	Asn	Thr	Ala	Arg	Leu	His	Gly
					245					250					255
Lys	Ala	Ala	Thr	Phe	Met	Pro	Lys	Pro	Leu	Ala	Gly	Asp	Asn	Gly	Ser
					260					265					270
Gly	Met	His	Ala	His	Gln	Ser	Leu	Trp	Lys	Asp	Gly	Lys	Pro	Leu	Phe
					275					280					285
His	Asp	Glu	Ser	Gly	Tyr	Ala	Gly	Leu	Ser	Asp	Ile	Ala	Arg	Tyr	Tyr
					290					295					300
Ile	Gly	Gly	Ile	Leu	His	His	Ala	Gly	Ala	Val	Leu	Ala	Phe	Thr	Asn
					305					310					320
Ala	Thr	Leu	Asn	Ser	Tyr	His	Arg	Leu	Val	Pro	Gly	Phe	Glu	Ala	Pro
					325					330					335
Ile	Asn	Leu	Val	Tyr	Ser	Gln	Arg	Asn	Arg	Ser	Ala	Ala	Val	Arg	Ile
					340					345					350
Pro	Ile	Thr	Gly	Ser	Asn	Pro	Lys	Ala	Lys	Arg	Ile	Glu	Phe	Arg	Ala
					355					360					365
Pro	Asp	Pro	Ser	Gly	Asn	Pro	Tyr	Leu	Gly	Phe	Ala	Ala	Met	Met	Met
					370					375					380
Ala	Gly	Leu	Asp	Gly	Ile	Lys	Asn	Arg	Ile	Glu	Pro	His	Ala	Pro	Val
					385					390					400
Asp	Lys	Asp	Leu	Tyr	Glu	Leu	Pro	Pro	Glu	Glu	Ala	Ala	Ser	Ile	Pro
					405					410					415
Gln	Ala	Pro	Thr	Ser	Leu	Glu	Ala	Ser	Leu	Lys	Ala	Leu	Gln	Glu	Asp
					420					425					430
Thr	Asp	Phe	Leu	Thr	Glu	Ser	Asp	Val	Phe	Thr	Glu	Asp	Leu	Ile	Glu
					435					440					445
Ala	Tyr	Ile	Gln	Tyr	Lys	Tyr	Asp	Asn	Glu	Ile	Ser	Pro	Val	Arg	Leu
					450					455					460
Arg	Pro	Thr	Pro	Gln	Glu	Phe	Glu	Leu	Tyr	Phe	Asp	Cys			
					465					470					475

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<210> 21
<211> 672
<212> DNA
<213> *Brevibacterium lactofermentum*

<220>
<221> CDS
<222> (1)..(669)

<400> 21	48
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Met Ala Gly Ala Val Gly Arg Pro Arg Arg Ser Ala Pro Arg Arg Ala	
1 5 10 15	
ggc aag aat cct cgc gag gag att ctt gac gcc tct gct gag ctt ttc	
Gly Lys Asn Pro Arg Glu Glu Ile Leu Asp Ala Ser Ala Glu Leu Phe	
20 25 30	
acc cat caa ggc ttc gca aca acc tcc acg cat caa atc gct gat gcc	
Thr His Gln Gly Phe Ala Thr Thr Ser Thr His Gln Ile Ala Asp Ala	
35 40 45	
gtg gga atc cgc caa gcc tcg ctg tat tat cac ttc ccg tct aag acg	
Val Gly Ile Arg Gln Ala Ser Leu Tyr Tyr His Phe Pro Ser Lys Thr	
50 55 60	
gaa atc ttc ctc acc ctc ctg aaa tct acc gtc gag ccg tcc act gtg	
Glu Ile Phe Leu Thr Leu Lys Ser Thr Val Glu Pro Ser Thr Val	
65 70 75 80	
ctc gcc gaa gac tta agc atc ctg gat gca gga cct gag atg cgc ctc	
Leu Ala Glu Asp Leu Ser Ile Leu Asp Ala Gly Pro Glu Met Arg Leu	
85 90 95	
tgg gca atc gtt gcc tcc gaa gtg cgt ctg ctg ctg tcc acc aag tgg	
Trp Ala Ile Val Ala Ser Glu Val Arg Leu Leu Leu Ser Thr Lys Trp	
100 105 110	
aac gtc ggt cgc ctg tac caa ctc ccc atc gtt ggt tct gaa gag ttc	
Asn Val Gly Arg Leu Tyr Gln Leu Pro Ile Val Gly Ser Glu Glu Phe	
115 120 125	
gcc gag tac cac agc cag cgc gaa gcc ctc acc aac atc ttc cgc gac	
Ala Glu Tyr His Ser Gln Arg Glu Ala Leu Thr Asn Ile Phe Arg Asp	
130 135 140	
ctc gcc acc gaa atc gtc ggt gac gac ccc cgc gca gaa ctc ccc ttc	
Leu Ala Thr Glu Ile Val Gly Asp Asp Pro Arg Ala Glu Leu Pro Phe	
145 150 155 160	
cac atc acc atg tcg gtg atc gaa atg cgt cgc aac gac ggc aag att	
His Ile Thr Met Ser Val Ile Glu Met Arg Arg Asn Asp Gly Lys Ile	
165 170 175	
cca agc ccg ctt tcc gca gac agc ctc ccg gag acc gca att atg ctt	
Pro Ser Pro Leu Ser Ala Asp Ser Leu Pro Glu Thr Ala Ile Met Leu	
180 185 190	
gcc gac gcc tcc ctc gcc gtc ctc ggc gcg tcg ctg ccc gcc gac cg ^g	
Ala Asp Ala Ser Leu Ala Val Leu Gly Ala Ser Leu Pro Ala Asp Arg	
195 200 205	
gtc gaa aaa acg ctt gaa cta atc aag cag gct gac ggc aaa taa cca	
Val Glu Lys Thr Leu Glu Leu Ile Lys Gln Ala Asp Ala Lys	
210 215 220	

<210> 22

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<211> 222

<212> PRT

<213> Brevibacterium lactofermentum

<400> 22

Met Ala Gly Ala Val Gly Arg Pro Arg Arg Ser Ala Pro Arg Arg Ala
 1 5 10 15
 Gly Lys Asn Pro Arg Glu Glu Ile Leu Asp Ala Ser Ala Glu Leu Phe
 20 25 30
 Thr His Gln Gly Phe Ala Thr Thr Ser Thr His Gln Ile Ala Asp Ala
 35 40 45
 Val Gly Ile Arg Gln Ala Ser Leu Tyr Tyr His Phe Pro Ser Lys Thr
 50 55 60
 Glu Ile Phe Leu Thr Leu Leu Lys Ser Thr Val Glu Pro Ser Thr Val
 65 70 75 80
 Leu Ala Glu Asp Leu Ser Ile Leu Asp Ala Gly Pro Glu Met Arg Leu
 85 90 95
 Trp Ala Ile Val Ala Ser Glu Val Arg Leu Leu Leu Ser Thr Lys Trp
 100 105 110
 Asn Val Gly Arg Leu Tyr Gln Leu Pro Ile Val Gly Ser Glu Glu Phe
 115 120 125
 Ala Glu Tyr His Ser Gln Arg Glu Ala Leu Thr Asn Ile Phe Arg Asp
 130 135 140
 Leu Ala Thr Glu Ile Val Gly Asp Asp Pro Arg Ala Glu Leu Pro Phe
 145 150 155 160
 His Ile Thr Met Ser Val Ile Glu Met Arg Arg Asn Asp Gly Lys Ile
 165 170 175
 Pro Ser Pro Leu Ser Ala Asp Ser Leu Pro Glu Thr Ala Ile Met Leu
 180 185 190
 Ala Asp Ala Ser Leu Ala Val Leu Gly Ala Ser Leu Pro Ala Asp Arg
 195 200 205
 Val Glu Lys Thr Leu Glu Leu Ile Lys Gln Ala Asp Ala Lys
 210 215 220

<210> 23

<211> 2076

<212> DNA

<213> Brevibacterium lactofermentum

<220>

<221> CDS

<222> (1)..(2076)

<400> 23

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Met Asn Asn Pro Ala Gln Leu Arg Gln Asp Thr Glu Lys Glu Val Leu	
1 5 10 15	
gcg ttg ctg ggc tct ttg gtt tta ccc gcc ggc acc gcg ctt gcc gcc	96
Ala Leu Leu Gly Ser Leu Val Leu Pro Ala Gly Thr Ala Leu Ala Ala	
20 25 30	
acc gga tct ttg gcc agg tcc gaa ctc acg ccg tat tcc gat ttg gac	144
Thr Gly Ser Leu Ala Arg Ser Glu Leu Thr Pro Tyr Ser Asp Leu Asp	
35 40 45	
ctc att ttg atc cat cca cca ggg gca acc ccg gat ggc gtg gag gat	192
Leu Ile Leu Ile His Pro Pro Gly Ala Thr Pro Asp Gly Val Glu Asp	

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atg gat cgc cac gga ttg tgg tcg cgt ttt gtt cca gaa tgg gac cgc	1104
Met Asp Arg His Gly Leu Trp Ser Arg Phe Val Pro Glu Trp Asp Arg	
355 360 365	
atc aaa ggg ctt atg ccc cgt gaa ccc agc cat att tcc acc atc gat	1152
Ile Lys Gly Leu Met Pro Arg Glu Pro Ser His Ile Ser Thr Ile Asp	
370 375 380	
gaa cat agt ctg aac act gtt gca gga tgt gcg cta gaa act gtg acc	1200
Glu His Ser Leu Asn Thr Val Ala Gly Cys Ala Leu Glu Thr Val Thr	
385 390 395 400	
gtc gcg cgc ccc gat ctt tta gtt ttg gga gcc ttg tac cac gac att	1248
Val Ala Arg Pro Asp Leu Leu Val Leu Gly Ala Leu Tyr His Asp Ile	
405 410 415	
ggc aag ggc ttc ccg cgt cca cac gaa caa gta ggt gca gag atg gtg	1296
Gly Lys Gly Phe Pro Arg Pro His Glu Gln Val Gly Ala Glu Met Val	
420 425 430	
gcg agg gcc gcg agc cgc atg ggg ttg aac ctt cgc gat cgt gcc agc	1344
Ala Arg Ala Ala Ser Arg Met Gly Leu Asn Leu Arg Asp Arg Ala Ser	
435 440 445	
gtg caa acg ctg gtc gcc gag cac acc gcg gtg gcc aaa atc gcc gcg	1392
Val Gln Thr Leu Val Ala Glu His Thr Ala Val Ala Lys Ile Ala Ala	
450 455 460	
cgc ctt gat ccc tcc tcg gag ggc gcc gtc gat aag ctg ctt gat gct	1440
Arg Leu Asp Pro Ser Ser Glu Gly Ala Val Asp Lys Leu Leu Asp Ala	
465 470 475 480	
gtt agg tat gac ctg gtg aca ttg aat ctg ctt gag gtg cta aca gaa	1488
Val Arg Tyr Asp Leu Val Thr Leu Asn Leu Leu Glu Val Leu Thr Glu	
485 490 495	
gct gat gcg aaa gcc acg ggg cct ggc gta tgg acg gcg cgt ttg gag	1536
Ala Asp Ala Lys Ala Thr Gly Pro Gly Val Trp Thr Ala Arg Leu Glu	
500 505 510	
cat gcg ctg cgg att gtg tgc aag cgt gcg cgt gat cgc ctc acc gat	1584
His Ala Leu Arg Ile Val Cys Lys Arg Ala Arg Asp Arg Leu Thr Asp	
515 520 525	
att cgc ccg gtt gcg ccg atg att gcg ccg cgt agc gaa att ggt ttg	1632
Ile Arg Pro Val Ala Pro Met Ile Ala Pro Arg Ser Glu Ile Gly Leu	
530 535 540	
gtg gaa cgc gat ggc gtg ttc aca gtg caa tgg cac ggc gaa gac tta	1680
Val Glu Arg Asp Gly Val Phe Thr Val Gln Trp His Gly Glu Asp Leu	
545 550 555 560	
cat cgg att ctt ggc gta att tat gcc aaa gga tgg aca atc acc gcg	1728
His Arg Ile Leu Gly Val Ile Tyr Ala Lys Gly Trp Thr Ile Thr Ala	
565 570 575	
gcg cgc atg ctg gcc aat ggt caa tgg agt gcg gaa ttt gat gtc cgc	1776
Ala Arg Met Leu Ala Asn Gly Gln Trp Ser Ala Glu Phe Asp Val Arg	
580 585 590	
gca aac ggc ccc caa gat ttt gat ccg cag cat ttc ctg cag gca tat	1824
Ala Asn Gly Pro Gln Asp Phe Asp Pro Gln His Phe Leu Gln Ala Tyr	
595 600 605	
caa tcc ggt gtg ttt tcc gag gtt ccc att cca gca cct ggg ata aca	1872
Gln Ser Gly Val Phe Ser Glu Val Pro Ile Pro Ala Pro Gly Ile Thr	
610 615 620	
gcc aca ttt tgg cac ggg aac act tta gaa gtg cgc act gag ctt cgc	1920
Ala Thr Phe Trp His Gly Asn Thr Leu Glu Val Arg Thr Glu Leu Arg	
625 630 635 640	
aca gga gct att ttt gcc ctg ctc aga aca ttg ccc gat gcc ctc tgg	1968

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Thr Gly Ala Ile Phe Ala Leu Leu Arg Thr Leu Pro Asp Ala Leu Trp			
645	650	655	
atc aac gct gtg acc cgc ggt gcg acc ctg att atc cag gca gca ctg			2016
Ile Asn Ala Val Thr Arg Gly Ala Thr Leu Ile Ile Gln Ala Ala Leu			
660	665	670	
aag ccc ggc ttc gat cga gca acg gtg gaa cgc tcc gta gtc agg tcg			2064
Lys Pro Gly Phe Asp Arg Ala Thr Val Glu Arg Ser Val Val Arg Ser			
675	680	685	
ttg gca ggt agc			2076
Leu Ala Gly Ser			
690			

<210> 24

<211> 692

<212> PRT

<213> *Brevibacterium lactofermentum*

<400> 24

Met Asn Asn Pro Ala Gln Leu Arg Gln Asp Thr Glu Lys Glu Val Leu			
1	5	10	15
Ala Leu Leu Gly Ser Leu Val Leu Pro Ala Gly Thr Ala Leu Ala Ala			
20	25	30	
Thr Gly Ser Leu Ala Arg Ser Glu Leu Thr Pro Tyr Ser Asp Leu Asp			
35	40	45	
Leu Ile Leu Ile His Pro Pro Gly Ala Thr Pro Asp Gly Val Glu Asp			
50	55	60	
Leu Trp Tyr Pro Ile Trp Asp Ala Lys Lys Arg Leu Asp Tyr Ser Val			
65	70	75	80
Arg Thr Pro Asp Glu Cys Val Ala Met Ile Ser Ala Asp Ser Thr Ala			
85	90	95	
Ala Leu Ala Met Leu Asp Leu Arg Phe Ile Ala Gly Asp Glu Asp Leu			
100	105	110	
Cys Ala Lys Thr Arg Arg Arg Ile Val Glu Lys Trp Arg Gln Glu Leu			
115	120	125	
Asn Lys Asn Phe Asp Ala Val Val Asp Thr Ala Ile Ala Arg Trp Arg			
130	135	140	
Arg Ser Gly Pro Val Val Ala Met Thr Arg Pro Asp Leu Lys His Gly			
145	150	155	160
Arg Gly Gly Leu Arg Asp Phe Glu Leu Ile Lys Ala Leu Ala Leu Gly			
165	170	175	
His Leu Cys Asn Val Pro Gln Leu Asp Thr Gln His Gln Leu Leu			
180	185	190	
Asp Ala Arg Thr Leu Leu His Val His Ala Arg Arg Ser Arg Asp Val			
195	200	205	
Leu Asp Pro Glu Phe Ala Val Asp Val Ala Met Asp Leu Gly Phe Val			
210	215	220	
Asp Arg Tyr His Leu Gly Arg Glu Ile Ala Asp Ala Ala Arg Ala Ile			
225	230	235	240
Asp Asp Gly Leu Thr Thr Ala Leu Ala Thr Ala Arg Gly Ile Leu Pro			
245	250	255	
Arg Arg Thr Gly Phe Ala Phe Arg Asn Ala Ser Arg Arg Pro Leu Asp			
260	265	270	
Leu Asp Val Val Asp Ala Asn Gly Thr Ile Glu Leu Ser Lys Lys Pro			
275	280	285	
Asp Leu Asn Asp Pro Ala Leu Pro Leu Arg Val Ala Ala Ala Ala			

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290	295	300													
Thr	Thr	Gly	Leu	Pro	Val	Ala	Glu	Ser	Thr	Trp	Ala	Arg	Leu	Asn	Glu
305	310	315	320												
Cys	Pro	Pro	Leu	Pro	Glu	Pro	Trp	Pro	Ala	Asn	Ala	Ala	Gly	Asp	Phe
		325	330	335											
Phe	Arg	Ile	Leu	Ser	Ser	Pro	Lys	Asn	Ser	Arg	Arg	Val	Val	Lys	Asn
		340	345	350											
Met	Asp	Arg	His	Gly	Leu	Trp	Ser	Arg	Phe	Val	Pro	Glu	Trp	Asp	Arg
		355	360	365											
Ile	Lys	Gly	Leu	Met	Pro	Arg	Glu	Pro	Ser	His	Ile	Ser	Thr	Ile	Asp
	370	375	380												
Glu	His	Ser	Leu	Asn	Thr	Val	Ala	Gly	Cys	Ala	Leu	Glu	Thr	Val	Thr
	385	390	395	400											
Val	Ala	Arg	Pro	Asp	Leu	Leu	Val	Leu	Gly	Ala	Leu	Tyr	His	Asp	Ile
	405	410	415												
Gly	Lys	Gly	Phe	Pro	Arg	Pro	His	Glu	Gln	Val	Gly	Ala	Glu	Met	Val
	420	425	430												
Ala	Arg	Ala	Ala	Ser	Arg	Met	Gly	Leu	Asn	Leu	Arg	Asp	Arg	Ala	Ser
	435	440	445												
Val	Gln	Thr	Leu	Val	Ala	Glu	His	Thr	Ala	Val	Ala	Lys	Ile	Ala	Ala
	450	455	460												
Arg	Leu	Asp	Pro	Ser	Ser	Glu	Gly	Ala	Val	Asp	Lys	Leu	Leu	Asp	Ala
	465	470	475	480											
Val	Arg	Tyr	Asp	Leu	Val	Thr	Leu	Asn	Leu	Leu	Glu	Val	Leu	Thr	Glu
	485	490	495												
Ala	Asp	Ala	Lys	Ala	Thr	Gly	Pro	Gly	Val	Trp	Thr	Ala	Arg	Leu	Glu
	500	505	510												
His	Ala	Leu	Arg	Ile	Val	Cys	Lys	Arg	Ala	Arg	Asp	Arg	Leu	Thr	Asp
	515	520	525												
Ile	Arg	Pro	Val	Ala	Pro	Met	Ile	Ala	Pro	Arg	Ser	Glu	Ile	Gly	Leu
	530	535	540												
Val	Glu	Arg	Asp	Gly	Val	Phe	Thr	Val	Gln	Trp	His	Gly	Glu	Asp	Leu
	545	550	555	560											
His	Arg	Ile	Leu	Gly	Val	Ile	Tyr	Ala	Lys	Gly	Trp	Thr	Ile	Thr	Ala
	565	570	575												
Ala	Arg	Met	Leu	Ala	Asn	Gly	Gln	Trp	Ser	Ala	Glu	Phe	Asp	Val	Arg
	580	585	590												
Ala	Asn	Gly	Pro	Gln	Asp	Phe	Asp	Pro	Gln	His	Phe	Leu	Gln	Ala	Tyr
	595	600	605												
Gln	Ser	Gly	Val	Phe	Ser	Glu	Val	Pro	Ile	Pro	Ala	Pro	Gly	Ile	Thr
	610	615	620												
Ala	Thr	Phe	Trp	His	Gly	Asn	Thr	Leu	Glu	Val	Arg	Thr	Glu	Leu	Arg
	625	630	635	640											
Thr	Gly	Ala	Ile	Phe	Ala	Leu	Leu	Arg	Thr	Leu	Pro	Asp	Ala	Leu	Trp
	645	650	655												
Ile	Asn	Ala	Val	Thr	Arg	Gly	Ala	Thr	Leu	Ile	Ile	Gln	Ala	Ala	Leu
	660	665	670												
Lys	Pro	Gly	Phe	Asp	Arg	Ala	Thr	Val	Glu	Arg	Ser	Val	Val	Arg	Ser
	675	680	685												
Leu	Ala	Gly	Ser												
	690														